JOURNAL OF THEORETICAL BIOLOGY

Co-Chief Editors: S. A. KAUFFMAN
L. WOLPERT

Editorial Board: N. BARTON
J. BONNER
A. CORNISH-BOWDEN
J. COWAN
J. A. DANI
F. DYSON
J. M. GELFAND
M. E. GILPIN
L. GLASS
A. GOLDBETER
B. GOODWIN
M. HASSALL
P. W. HEDRICK
T. B. L. KIRKWOOD
J. H. LEWIS
W. R. LIEB
R. B. LUFTIG
R. M. MAY
J. MAYNARD SMITH
J. D. MURRAY
T. OHTA
H. H. PATTEE
A. S. PERELSON
S. L. PIMM
J. RINZEL
M. R. ROSE
M. SAVAGEAU
P. SCHUSTER
T. TAKENAKA
J. TYSON
J. Z. YOUNG

VOLUME 149
March–April 1991

ACADEMIC PRESS

London San Diego New York Boston
Sydney Tokyo Toronto

Copyright © 1991, by Academic Press Limited

ALL RIGHTS RESERVED

No part of this volume may be reproduced in any form, by photostat, microfilm, or any other means, without written permission from the publishers.

Printed in Great Britain

Contents for Volume 149

Number 1, 7 March 1991

RAUDINO, A. and BIANCIARDI, P., Polymer-mediated Electrostatic Interactions between Charged Lipid Assemblies and Electrolyte Solutions: A Tentative Model of the Polyethylene Glycol-induced Cell Fusion 1

NUSSINOV, R., The Ordering of Nucleotides in the DNA: Strong Pyrimidine–Purine Patterns Near Homooligomer Tracts 21

SHABALINA, S. A., YURIEVA, O. V. and KONDRASHOV, A. S., On the Frequencies of Nucleotides and Nucleotide substitutions in Conservative Regulatory DNA Sequences 43

PLONSEY, R., STARMER, C. F. and TIPĀNS, I., The Quantitative Investigation of the Binding Process of Calcium Blocking Drugs in a Sinoatrial Node 55

BULL, J. J. and RICE, W. R., Distinguishing Mechanisms for the Evolution of Co-operation 63

PAMILO, P., Evolution of the Sterile Caste 75

JACOBSON, J. I., A Look at the Possible Mechanism and Potential of Magneto Therapy 97

HAMMOND, B. J., CHRISTENSEN, J. R. and SMITH, G. D., A Model of Insulin Distribution and Uptake in the Perfused Rat Liver 121

LETTER TO THE EDITOR

KACSER, H., A Superior Theory? 141

Number 2, 21 March 1991

TANAKA, Y., The Evolution of Social Communication Systems in a Subdivided Population 145

PACALA, S. W. and WEINER, J., Effects of Competitive Asymmetry on a Local Density Model of Plant Interference 165

MURASE, M., Excitable Dynein Model with Multiple Active Sites for Large-amplitude Oscillations and Bend Propagation in Flagella . . . 181

YEAKLEY, J. A. and CALE, W. G., Organizational Levels Analysis: A Key to Understanding Processes in Natural Systems 203

TRAVIS, C. C. and BIRKNER, P. D., Druckery Slope Controlled by Mitotic Rate of Enzymatically-altered Foci 217

VAN LEEUWEN, J. L., Optimum Power Output and Structural Design of Sarcomeres 229

ZHANG, C.-T. and SHANG, Z.-X., The Study of Stacking Energy for Natural DNA Sequences 257

GOSSELIN, R. E. and KAPLOW, S. M., Venous Waterfalls in Coronary Circulation 265

CANNINGS, C. and WHITTAKER, J. C., A Two-trial Two-strategy Conflict 281

Number 3, 7 April 1991

ZHENG, T., A Mathematical Model of Proliferation and Aging of Cells in Culture 287

KUMAMOTO, E., Short-term Facilitation as a Tool to Know Neuromodulator-induced Change in Ca^{2+} Movement in the Nerve Terminal . . 317

SEKIMURA, T. and HOTANI, H., The Morphogenesis of Liposomes Viewed from the Aspect of Bending Energy 325

MURRAY, J. D. and MYERSCOUGH, M. R., Pigmentation Pattern Formation on Snakes 339

BROOKS, S. P. J. and STOREY, K. B., A Quantitative Evaluation of the Effect of Enzyme Complexes on the Glycolytic Rate *in vivo*: Mathematical Modeling of the Glycolytic Complex 361

KOZIOL, J. A., On the Prevalence of Transcriptional Regions in Human Genomic DNA 377

DE BOER, R. J. and PERELSON, A. S., Size and Connectivity as Emergent Properties of a Developing Immune Network 381

LETTER TO THE EDITOR

COUTINHO, A., Size and Connectivity: a Bit of the History of Immune Networks 425

Number 4, 21 April 1991

FISHER, R. E. and MAYOR, H. D., The Evolution of Defective and Autonomous Parvoviruses 429

WOLFE, K. H., Mammalian DNA Replication: Mutation Biases and the Mutation Rate 441

MORELLI, R. A., WALDE, R. E., AKSTIN, E. and SCHNEIDER, C. W., L-system Representation of Speciation in the Red Algal Genus *Dipterosiphonia* (Ceramiales, Rhodomelaceae) 453

KAUFFMAN, S. A. and JOHNSEN, S., Coevolution to the Edge of Chaos: Coupled Fitness Landscapes, Poised States, and the Coevolutionary Avalanches 467

HANNON, B., Empirical Cyclic Stabilization of an Oyster Reef Ecosystem 507

CASCANTE, M., SORRIBAS, A., FRANCO, R. and CANELA, E. I., Biochemical Systems Theory: Increasing Predictive Power by using Second-order Derivatives Measurements 521

SHAKHNOVICH, E. I. and GUTIN, A. M., Influence of Point Mutations on Protein Structure: Probability of a Neutral Mutation 537

CAMAZINE, S. and SNEYD, J., A Model of Collective Nectar Source Selection by Honey Bees: Self-organization Through Simple Rules . . . 547

Index to Volume 149

A superior theory? (letter), 141
Aging of cells in culture, a mathematical model of proliferation and, 287
AKSTIN, E. (see MORELLI, R. A.), 453
Asymmetry, competitive; effects on a local density model of plant interference, 165

Bend propagation in flagella, excitable dynein model with multiple active sites for large-amplitude oscillations and, 181
Bending energy, the morphogenesis of liposomes viewed from the aspect of, 325
BIANCIARDI, P. (see RAUDINO, A.), 1
Binding process of calcium blocking drugs in a sinoatrial node; quantitative investigation, 55
Biochemical systems theory: increasing predictive power by using second-order derivatives measurements, 521
BIRKNER, P. D. (see TRAVIS, C. C.), 217
BROOKES, S. P. J. and STOREY, K. B., A quantitative evaluation of the effect of enzyme complexes on the glycolytic rate *in vivo*: mathematical modeling of the glycolytic complex, 361
BULL, J. J. and RICE, W. R., Distinguishing mechanisms for the evolution of co-operation, 63

Calcium blocking drugs, the quantitative investigation of the binding process of, in a sinoatrial node, 55
Ca^{2+} movement in the nerve terminal, short-term facilitation as a tool to know neuromodulator-induced change in, 317
CALE, W. G. (see YEAKLEY, J. A.), 203
CAMAZINE, S. and SNEYD, J., A model of collective nectar source selection by honey bees: self-organization through simple rules, 547
CANNINGS, C. and WHITTAKER, J. C., A two-trial two-strategy conflict, 281
CANELA, E. I. (see CASCANTE, M.), 521
CASCANTE, M., SORRIBAS, A., FRANCO, R. and CANELA, E. I., Biochemical systems theory: increasing predictive power by using second-order derivatives measurements, 521
Cells in culture, a mathematical model of proliferation and aging in, 287
Cell fusion, polyethylene glycol-induced, a tentative model; polymer-mediated electrostatic interactions between charged lipid assemblies and electrolyte solutions, 1
Chaos, coevolution to the edge of; coupled fitness landscapes, poised states, and the coevolutionary avalanches, 467
CHRISTENSEN, J. R. (see HAMMOND, B. J.), 121
Circulation, coronary, venous waterfalls in, 265
Coevolution to the edge of chaos: coupled fitness landscapes, poised states, and the coevolutionary avalanches, 467
Collective nectar source selection by honey bees, a model; self-organization through simple rules, 547
Communication systems, social, in a subdivided population, the evolution of, 145
Competitive asymmetry: effects on a local density model of plant interference, 165
Conflict, two-strategy, two-trial, 281
Connectivity and size: a bit of the history of immune networks (letter), 425
Connectivity and size as emergent properties of a developing immune network, 381
Co-operation, distinguishing mechanisms for the evolution of, 63

Coronary circulation, venous waterfalls in, 265
COUTINHO, A., Size and connectivity: a bit of the history of immune networks (letter), 425

DE BOER, R. J. and PERELSON, A. S., Size and connectivity as emergent properties of a developing immune network, 381
Dipterosiphonia (Ceramiales, Rhodomelaceae), red algal genus, L-system representation of speciation in, 453
DNA, genomic, human, on the prevalence of transcriptional regions in, 377
DNA, ordering of nucleotides in; strong pyrimidine-purine patterns near homoligomer tracts, 21
DNA replication, mammalian; mutation biases and mutation rate, 441
DNA sequences, natural, stacking energy for, 257
DNA sequences, regulatory, conservative, on the frequencies of nucleotides and nucleotide substitutions in, 43
Druckery slope controlled by mitotic rate of enzymatically-altered foci, 217
Drugs, calcium blocking, quantitative investigation of the binding process of, in a sinoatrial node, 55
Dynein model with multiple active sites for large-amplitude oscillations and bend propagation in flagella, 181

Ecosystem, oyster reef, empirical cyclic stabilization of, 507
Electrolyte solutions, polymer-mediated electrostatic interactions between charged lipid assemblies and; a tentative model of the polyethylene glycol-induced cell fusion, 1
Electrostatic interactions, polymer-mediated, between charged lipid assemblies and electrolyte solutions: a tentative model of the polyethylene glycol-induced cell fusion, 1
Energy, bending, the morphogenesis of liposomes viewed from the aspect of, 325
Energy, stacking, for natural DNA sequences, 257
Enzymatically-altered foci, druckery slope controlled by mitotic rate of, 217
Enzyme complexes, a quantitative evaluation of their effect on the glycolytic rate *in vivo*; modeling of the glycolytic complex, 361
Evolution of co-operation, distinguishing mechanisms for, 63
Evolution of defective and autonomous parvoviruses, 429
Evolution of social communication systems in a subdivided population, 145
Evolution of the sterile cast, 75

FISHER, R. E. and MAYOR, H. D., The evolution of defective and autonomous parvoviruses, 429
Flagella, excitable dynein model with multiple active sites for large-amplitude oscillations and bend propagation in, 181
Foci, enzymatically-altered, druckery slope controlled by mitotic rate of, 217
FRANCO, R. (see CASCANTE, M.), 521
Frequencies of nucleotides and nucleotide substitutions in conservative regulatory DNA sequences, 443

Genomic DNA, human, on the prevalence of transcriptional regions in, 377
Glycolytic rate *in vivo*, a quantitative evaluation of the effect of enzyme complexes on; modeling of the glycolytic complex, 361
GOSSELIN, R. E. aand KAPLOW, S. M., Venous waterfalls in coronary circulation, 265
GUTIN, A. M. (see SHAKHNOVICH, E. I.), 537
HAMMOND, B. J., CHRISTENSEN, J. R. and SMITH, G. D., A model of insulin distribution and uptake in the perfused rat liver, 121
HANNON, B., Empirical cyclic stabilization of an oyster reef ecosystem, 507
Homooligomer tracts, the ordering of nucleotides in the DNA: strong pyrimidine-purine patterns near, 21

Honey bees, a model of collective nectar source selection by; self-organization through simple rules, 547
HOTANI, H. (see SEKIMURA, T.), 325
Human genomic DNA, on the prevalence of transcriptional regions in, 377

Immune network, developing, size and connectivity as emergent properties of, 381
Immune networks, a bit of the history of; size and connectivity (letter), 425
Insulin distribution and uptake in the perfused rat liver, a model of, 121
Interference, plant, effects of competitive asymmetry on a local density model of, 165

JACOBSON, J. I., A look at the possible mechanism and potential of magneto therapy, 97
JOHNSEN, S. (see KAUFFMAN, S. A.), 467

KACSER, H., A superior theory (letter), 141
KAPLOW, S. M. (see GOSSELIN, R. E.), 265
KAUFFMAN, S. A. and JOHNSEN, S., Coevolution to the edge of chaos: coupled fitness landscapes, poised states, and the coevolutionary avalanches, 467
KONDRASHOV, A. S. (see SHABALINA, S. A.), 43
KOZIOL, J. A., On the prevalence of transcriptional regions in human genomic DNA, 377
KUMAMOTO, E., Short-term oscillations as a tool to know neuromodulator-induced change in Ca^{2+} movement in the nerve terminal, 317

Lipid assemblies, charged, and electrolyte solutions, polymer-mediated electrostatic interactions between; a tentative model of the polyethylene glycol-induced cell fusion, 1
Liposome morphogenesis viewed from the aspect of bending energy, 325
Liver, rat, perfused, a model of insulin distribution and uptake in, 121
L-system representation of speciation in the red algal genus *Dipterosiphonia* (Ceramiales, Rhodomelaceae), 453

Magneto therapy, a look at the possible mechanism and potential of, 97
Mammalian DNA replication: mutation biases and mutation rate, 441
MAYOR, H. D. (see FISHER, R. E.), 429
Mitotic rate enzymatically-altered foci, druckery slope controlled by, 217
MORELLI, R. A., WALDE, R. E., AKSTIN, E. and SCHNEIDER, C. W., L-system representation of speciation in the red algal genus *Dipterosiphonia* (Ceramiales, Rhodomelaceae), 453
Morphogenesis of liposomes viewed from the aspect of bending energy, 325
MURASE, M., Excitable dynein model with multiple active sites for large-amplitude oscillations and bend propagation in flagella, 181
MURRAY, J. D. and MYERSCOUGH, M. R., Pigmentation pattern formation on snakes, 339
Mutations, point, influence on protein structure: probability of a neutral mutation, 537
MYERSCOUGH, M. R. (see MURRAY, J. D.), 339

Nectar source selection, collective, by honey bees, a model; self-organization through simple rules, 547
Neuromodulator-induced change in Ca^{2+} movement in the nerve terminal, short-term facilitation as a tool to know, 317
Nucleotides and nucleotide substitutions in conservative regulatory DNA sequences, on the frequencues of, 43
Nucleotide ordering in DNA: strong pyrimidine-purine patterns near homooligomer tracts, 21
NUSSINOV, R., The ordering of nucleotides in the DNA: strong pyrimidine-purine patterns near homooligomer tracts, 21

Organizational levels analysis: a key to understanding processes in natural systems, 203
Oscillations, large-amplitude, and bend propagation in flagella, excitable dynein model with multiple active sites for, 181
Oyster reef ecosystem, empirical cyclic stabilization of, 507

PACALA, S. W. and WEINER, J., Effects of competitive asymmetry on a local density model of plant interference, 165
PAMILO, P., Evolution of the sterile caste, 75
Parvoviruses, defective and autonomous, the evolution of, 429
Pattern formation of pigmentation on snakes, 339
PERELSON, A. S. (see DE BOER, R. J.), 381
Pigmentation pattern formation on snakes, 339
Plant interference, effects of competitive asymmetry on a local density model of, 165
PLONSEY, R., STARMER, C. F. and TIPĀNS, I., The quantitative investigation of the binding process of calcium blocking drugs in a sinoatrial node, 55
Polyethylene glycol-induced cell fusion, a tentative model; polymer-mediated electrostatic interactions between charged lipid assemblies and electrolyte solutions, 1
Population, subdivided, the evolution of social communication systems in, 145
Power output, optimal, and structural design of sarcomeres, 229
Proliferation and aging of cells in cultures; a mathematical model, 287
Protein structure, influence of point mutations on; probability of a neutral mutation, 537
Pyrimidine-purine patterns near homooligomer tracts; the ordering of nucleotides in DNA, 21

Rat liver, perfused, a model of insulin distribution and uptake in, 121
RAUDINO, A. and BIANCIARDI, P., Polymer-mediated electrostatic interactions between charged lipid assemblies and electrolyte solutions: a tentative model of the polyethylene glycol-induced cell fusion, 1
Red algal genus *Dipterosiphonia* (Ceramiales, Rhodomelaceae), L-system representation of speciation in, 453
Regulatory DNA sequences, conservative, on the frequencies of nucleotides and nucleotide substitutions in, 43
Replication, DNA, mammalian; mutation biases and mutation rate, 441
RICE, W. R. (see BULL, J. J.), 63

Sarcomeres, optimum power output and structural design of, 229
SCHNEIDER, C. W. (see MORELLI, R. A.), 453
SEKIMURA, T. and HOTANI, H., The morphogenesis of liposomes viewed from the aspect of bending energy, 325
Self-organization through simple rules: a model of collective nectar source selection by honey bees, 547
SHABALINA, S. A., YURIEVA, O. V. and KONDRASHOV, A. S., On the frequencies of nucleotides and nucleotide substitutions in conservative regulatory DNA sequences, 43
SHAKHNOVICH, E. I. and GUTIN, A. M., Influence of point mutations on protein structure: probability of a neutral mutation, 537
SHANG, Z.-X. (see ZHANG, C.-T.), 257
Sinoatrial node, the quantitative investigation of the binding proocess of calcium blocking drugs in, 55
Size and connectivity as emergent properties of a developing immune network, 381
Size and connectivity: a bit of the history of immune network (letter), 425
SMITH, G. D. (see HAMMOND, B. J.), 121
Snakes, pigmentation pattern formation on, 339
SNEYD, J. (see CAMAZINE, S.), 547
Social communication systems in a subdivided population, the evolution of, 145
SORRIBAS, A. (see CASCANTE, M.), 521

Speciation in the red algal genus *Dipterosiphonia* (Ceramiales, Rhodomelaceae), L-system representation of, 453
Stabilization, cyclic, empirical, of an oyster reef ecosystem, 507
Stacking energy for natural DNA sequences, 257
STARMER, C. F. (see PLONSEY, R.), 55
Sterile caste, evolution of, 75
STOREY, K. B. (see BROOKES, S. P. J.), 361
Structural design of sarcomeres, optimal power output and, 229
Structure, protein, influence of point mutations on; probability of a neutral mutation, 537

TANAKA, Y., The evolution of social communication systems in a subdivided population, 145
TIPÄNS, I. (see PLONSEY, R.), 55
Transcriptional regions: prevalence in human genomic DNA, 377
TRAVIS, C. C. and BIRKNER, P. D., Druckery slope controlled by mitotic rate of enzymatically altered foci, 217

VAN LEEUWEN, J. L., Optimum power output and structural design of sarcomeres, 229
Venous waterfalls in coronary circulation, 265
WALDE, R. E. (see MORELLI, R. A.), 563
Waterfalls, venous, in coronary circulation, 265
WEINER, J. (see PACALA, S. W.), 165
WHITTAKER, J. C. (see CANNINGS, C.), 281
WOLFE, K. H., Mammalian DNA replication: mutation biases and the mutation rate, 441

YEAKLEY, J. A. and CALE, W. G., Organizational levels analysis: a key to understanding processes in natural systems, 203
YURIEVA, O. V. (see SHABALINA, S. A.), 43

ZHANG, C.-T. and SHANG, Z.-X., The study of stacking energy for natural DNA sequences, 257
ZHENG, T., A mathematical model of proliferation and aging of cells in culture, 287